

Laboratory Acquired Infections



Lab Safety Coordinators' Meeting
November 28, 2012

The five most predominant routes:

1. Parenteral inoculations with syringe needles or other contaminated sharps;
2. Spills and splashes onto skin and mucous membranes;
3. Ingestion or exposure through mouth pipetting or touching mouth or eyes with fingers or contaminated objects;
4. Animal bites and scratches (research laboratories or activities); and
5. Inhalation of infectious aerosols.

Headlines:

- Texas A&M University Violates Federal Law in Biodefense Lab Infection (Brucella) --- April 2007
- Fatal Laboratory-Acquired Infection with an Attenuated Yersinia pestis Strain --- Chicago, Illinois, 2009
- Salmonella hits US teaching labs (2 at UMass) --- August 2010 to May 2011
- First U.S. Cowpox Infection: Acquired From Lab Contamination --- Illinois, February 2011
- Contamination of a Microbiology Laboratory --- Chicago, August 2011
- Researcher dies after handling a rare bacteria strain --- San Francisco, May 2012

Texas A&M University Violates Federal Law in Biodefense Lab Infection --- April 2007

- Person climbs into dirty bioaerosol chamber to clean it and contracts brucellosis (never should be done)
- A&M **failed to report the incident** to federal authorities
- Lost federal funding and paid \$250,000 in fines.
- Select Agent program was shut down in 2007 and is just beginning to resume this program in spring of 2012
- Lost researchers, staff and reputation
- Still recovering after 5 years

Fatal Laboratory-Acquired Infection with an Attenuated *Yersinia pestis* Strain --- Chicago, 2009

- September 10th, the researcher aged 60 years with insulin-dependent diabetes mellitus, was evaluated at an outpatient clinic for fever, body aches, and cough of approximately 3 days duration
- September 13, the patient was brought by ambulance to a Chicago hospital ED because of fever, cough, and worsening shortness of breath. The patient expired. Hospital did not know patient worked with Select Agents.
- Last day of work in the lab was September 4th.
- Non-compliant with training and glove use
- Strain had been modified and not reported to IBC
- Patient had hereditary hemochromatosis (high iron levels)
- Virulence of pgm- *Y. pestis* strains can be enhanced by the simultaneous injection of iron
- Patient was immunocompromised due to diabetes as well

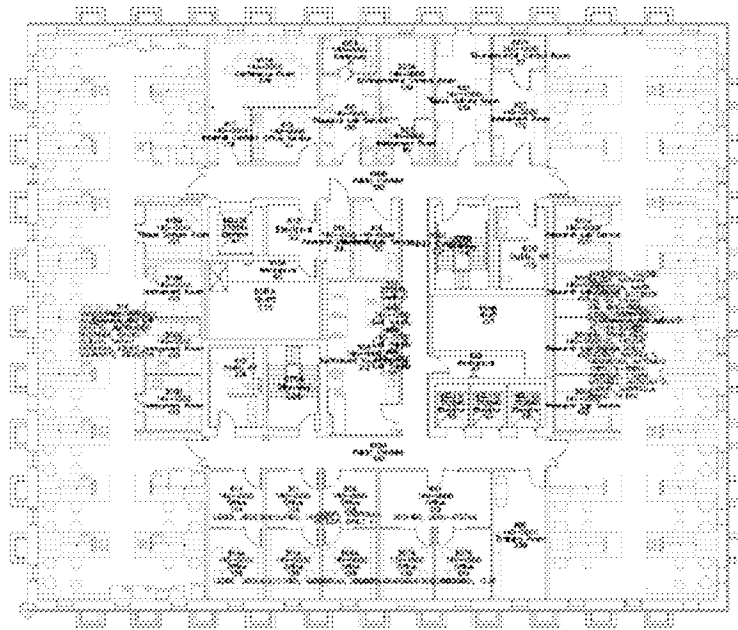
Salmonella hits US teaching labs --- August 2010 to May 2011

- 73 infections due to *Salmonella typhimurium* across 35 states
- Many of the illnesses have been traced back to clinical or teaching laboratories (2 students at UMass Amherst)
- 60% of them had had some connection with a microbiology laboratory in the week before their illness
- It is unusual for lab acquired infections to crop up across the country, and the CDC investigated how this may have happened
- Some of those made ill in the outbreak, such as young children, had never visited a lab but lived with someone who worked in a lab and did not get sick. This suggests that the lab worker carried the pathogenic bacteria home on bags, clothes or other objects
- And it raises the question of whether use of this pathogenic *Salmonella* strain in teaching labs is necessary.

First U.S. Cowpox Infection: Acquired From Lab Contamination --- Illinois, February 2011

- A student laboratory worker at the University of Illinois, Urbana-Champaign, is the first person in the US to come down with cowpox, a less dangerous relative of smallpox, and the culprit is lab contamination.
- Researchers from the CDC reported that the unvaccinated patient was infected by a genetically modified cowpox virus strain in her research lab, one she had never even worked with, by inadvertently handling contaminated materials.
- CDC recommends smallpox vaccination for all lab workers who come in contact with intact orthopoxviruses, a category that includes vaccinia, cowpox, and other animal viruses. The patient had declined vaccination since she had no intention of handling the virus, and the lab hadn't worked on cowpox for 5 years previous to the incident.
- Infections from labs may be more common than reported partly because labs don't want the blame and partly because in the absence of a needle stick, patients have trouble pinning down why they are sick.

Skin Infection Caused by Bacillus Cereus --- Chicago, August 2011



Skin Infection Caused by Bacillus Cereus ---
Chicago, August 2011

1. Large Lab A:

- *Bacillus anthracis*-Sterne*
- *Bacillus cereus**
- ATCC14579 (BSL2)
- G9241 (BSL2 w/BSL3 practices)
- *Staphylococcus aureus*
- *Yersinia enterocolitica**

2. Large Lab B:

- *Listeria monocytogenes*
- *Staphylococcus aureus*

3. Common areas:

- BSC Room
- Autoclave room
- Environmental rooms
- Microscope room
- Freezer farm
- Break area
- Conference room

4. Offices

Skin Infection Caused by Bacillus Cereus ---
Chicago, August 2011

▪ **Thursday, August 25, 2011 (evening)**

Investigator scratches blemish/skin lesion with fingers (reported retrospectively during investigation).

▪ **Friday, August 26, 2011**

Investigator notices a swelling immediately surrounding the lesion skin and reports to PI; PI instructs investigator to meet again in AM.

Skin Infection Caused by *Bacillus Cereus* ---
Chicago, August 2011

- **Saturday, August 27, 2011**
 - Investigator meets with PI (7:30AM); swelling surrounding an ulceration is observed.
 - Patient referred to Emergency Department for assessment of skin lesion.
 - Infectious Diseases and BSO notified.
 - Differential diagnosis = necrotizing fasciitis.
 - Clinical microbiology reports presence of Gram + rods in tissue biopsy.
 - Surgery performed for debridement of necrotic material (~9:30 PM)

Skin Infection Caused by *Bacillus Cereus* ---
Chicago, August 2011

- **Sunday, August 28, 2011**
 - Presumptive identification as *Bacillus cereus*; confirmation by Clinical and Microbiology team of potential laboratory infection.
 - Genomic DNA purified for PCR; results obtained later in day.
 - Internal notifications made.
 - External notifications made.
 - CDPH/IDPH
 - NIH-NIAID, NIH-OBA
 - CDC, CDC-SAP
 - OSHA (Monday, August 29, 2011)

Skin Infection Caused by *Bacillus Cereus* ---
Chicago, August 2011

- **Sunday, August 28, 2011 (cont.)**
- Hospital Epidemiologist initiates surveillance program and evaluates clinical staff, co-workers, researcher's friends and family members for exposure risk.
- Prophylaxis prescribed when appropriate.
- All work on *B. cereus* G9241 suspended except for experiments to molecularly characterize DNA from clinical isolate (obtained from Clinical Microbiology).
- Horizontal and vertical work surfaces in lab wiped down with 10% concentration bleach solution.

Skin Infection Caused by *Bacillus Cereus* ---
Chicago, August 2011

- **Monday, August 29, 2011**
- UC Safety Team convened to assess patient status, surveillance and prophylaxis activities to date, decontamination activities, communications, and external notifications. Confirmed daily meeting timeline for continued surveillance and action planning.
- *Bacillus cereus* G9241 strain removed from the Cummings Laboratory (A) and transferred to the Ricketts BSL 3 facility (20 miles away).
- Staff meetings conducted with the Department of Microbiology and the staff working in the laboratory.

Skin Infection Caused by Bacillus Cereus ---
Chicago, August 2011

- **Teleconference conducted with CDPH to review summary of case, current decontamination efforts, surveillance and prophylaxis, laboratory safety. Continued communications with CDC/CDPH to review decontamination strategies, patient treatment options and prophylaxis.**
- **Tuesday, August 30, 2011**
 - Continued infection control surveillance including development of an on-line survey for 6th floor staff to assess for signs and symptoms.
 - Survey sent daily for a 14 day period.
 - Survey posted in common areas around 6th floor.
 - Continued communications with CDC/CDPH.

Skin Infection Caused by Bacillus Cereus ---
Chicago, August 2011

- **Wednesday, August 31, 2011**
 - 6th Floor closure occurred at the start of the business day. Rooms A and B vacated and secured. The interior office space closed and secured.
 - CDPH on-site review. Teleconference with CDC.
- **Friday, September 2, 2011**
 - Meeting with building occupants to inform them of incident and response plan.
- **Sept. 8, 9, 16, 23, 30**
 - Continuing meetings with building occupants to update on response activities.
- **September 8-10, 2011**
 - Culling and surface decontamination.

Skin Infection Caused by Bacillus Cereus ---
Chicago, August 2011

- **September 15-16, 2011**
- **VHP decon of 6th floor**
- **September 20, 26 and October 20, 2011**
- **BSL2 re-training for all staff and infected investigator.**
- **September 23, 2011**
- **6th floor released back to occupants.**

Skin Infection Caused by Bacillus Cereus ---
Chicago, August 2011

- **CULLING (ALL ITEMS DISPOSED AS RED BAG WASTE)**
- 1. **All notebooks, books, paper items disposed.**
- 2. **All lab supplies disposed.**
- 3. **All buffers and media sewered; bottles autoclaved and then placed on surface-decontaminated lab benches.**
- 4. **Reagent bottles/buffers autoclaved and then placed on surface-decontaminated lab benches.**
- 5. **Any equipment (including computers) that could not be surface-decontaminated was left for VHP treatment or disposed.**

Skin Infection Caused by Bacillus Cereus --- Chicago,
August 2011

▪ **SURFACE DECON (X2) .5% SODIUM HYPOCHLORITE (PH7) FOR 30 MINUTES CONTACT TIME**

1. All lab areas, especially common equipment rooms (6th floor).
2. All equipment, especially handles, etc.
3. Conference room and break room (6th floor).
4. Office desks, door handles and light switches (6th floor).
5. Elevator walls and floors.
6. Stairwells from Ground to 11th Floor.

Skin Infection Caused by Bacillus Cereus --- Chicago,
August 2011

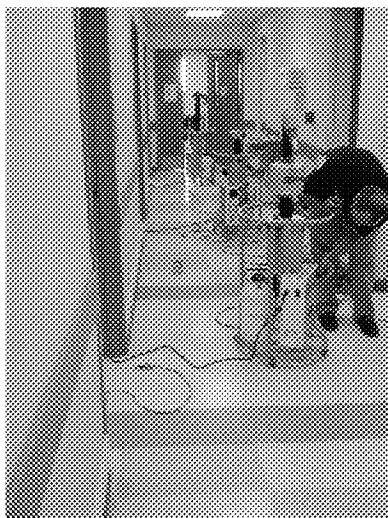
▪ **Vaporized Hydrogen Peroxide Decontamination**

- **Performed by Bioquell.**
- **Activity coordinated with Building occupants.**
- **Performed at night (Biosafety staff on site to monitor H2O2).**
- **All sixth floor areas, including offices.**
- **Biological indicators incubated for 7 days prior to release of space back to investigators.**

Skin Infection Caused by Bacillus Cereus --- Chicago,
August 2011



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Decontamination Costs	
SET Environmental	\$44,262.71
Stericycle (waste disposal)	\$2,356.76
Bioquell	\$29,450.00
SUB-TOTAL	\$76,069.47

Facilities Costs	
Oris Elevator	\$2,610.37
International Test & Balance	\$1,887.50
HTS (HEF Technical Services)	\$640.00
Conference Room Furniture Replacement	\$1,245.25
SUB-TOTAL	\$6,383.12

Microbiology Costs		
Supply replacement	HTRL	\$25,478.53
	CLSC	\$110,754.38
Equipment purchases	HTRL	\$71,933.20
	CLSC	\$248,134.00
BSD install costs		\$3,025.00
Equipment moving costs		\$4,847.50
SUB-TOTAL		\$453,222.61

Loss of research ^a	
Research Tech -- 1 FTE for 1 year	\$43,112.60
Research Tech -- 1 FTE for 1 year	\$43,112.60
Freezer -- 80° C	\$6,200.00
SUB-TOTAL	\$92,425.20

Total Cost Estimate: \$633,798.60

Skin Infection Caused by *Bacillus Cereus* --- Chicago, August 2011

▪ BSL2 RE-TRAINING

1. Classroom:

- Review of BSL2:
- Standard Practices
- Special Practices
- PPE and Equipment (esp. BSC)
- Facility
- Occupational Medicine
- Occupational exposure and first aid.
- Health watch.
- Spills

2. Hands-On:

- BSC start-up, working in a BSC and BSC shut-down.
- Waste preparation and disposal.
- Biohazardous spill clean-up.

Skin Infection Caused by *Bacillus Cereus* --- Chicago, August 2011

▪ PROGRAMMATIC IMPROVEMENTS

1. Segregation of agents:

- All *Bacillus sp.* moved to Ricketts Lab. (all spore-formers)
- *Bacillus cereus* pBCXO1+ strains moved to BSL3.
- *Yersinia enterocolitica* moved to Ricketts (BSL2)
- Only *Staphylococcus aureus* remains in large lab A.

2. Equipment purchases.

- 6 additional BSCs; 3 placed in each large lab on 6.
- Additional centrifuges purchased.

3. Code of Conduct established.

Skin Infection Caused by *Bacillus Cereus* --- Chicago,
August 2011

▪ **LESSONS**

1. Most drowning accidents occur in shallow water.
2. Safety (and security) are a shared responsibility.
3. Robust Occupational Medicine program is essential.
4. Basic infection control practices and adherence to BSL2 procedures are critical!
5. Segregate agents as much as possible.
6. Important to provide dedicated space for non-experimental activities and personal belongings
7. Financial losses can be staggering (NOT SUSTAINABLE); losses in community confidence and public support is a death sentence for important research endeavors.

Researcher dies after handling a rare bacteria strain
--- San Francisco, May 2012

- The researcher was helping to develop a vaccine for a meningitis strain resistant to vaccine and wasn't vaccinated for the illness despite CDC recommendations to the contrary
- Richard Din fell ill with a headache and other flu-like symptoms about two hours after leaving work. He awoke Saturday feeling worse and with a rash all over his body, and he was rushed to the hospital by friends. Din lost consciousness in the car and died in the hospital of a heart attack at about 2 p.m.
- The vaccine-resistant strain of bacteria was found in his bloodstream.
- He was an excellent lab worker and very fastidious and there were no signs of spills or mechanical failure in the laboratory.
- The lab was decontaminated and temporarily closed pending investigations.

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- Legend:
- 10% or less
 - 15% or more
 - 20% or more

- On October 30, 2010, PulseNet, the national molecular subtyping network for foodborne disease surveillance, detected a multistate cluster of *Salmonella* Typhimurium infections with a particular pulsed-field gel electrophoresis (PFGE) pattern and other genetic characteristics, referred to here as strain X.
- Infected individuals ranged in age from less than 1 year to 91 years old, and the median age was 21 years. Sixty-one percent of patients were female. Twelve percent of patients were hospitalized. One death was reported.
- The investigation focused on potential risk factors in microbiology laboratories that work with infectious agents like strain X of *Salmonella* Typhimurium.
- Teaching and clinical microbiology laboratory instructors should enhance training of students and staff on biosafety measures necessary in the laboratory

Advice to Students and Employees in Clinical and Teaching Microbiology Laboratories

- Be aware that bacteria used in microbiology laboratories can make you or others who live in your household sick, especially young children, even if they have never visited the laboratory.
- If you work in a laboratory, it is possible for you to bring bacteria home through contaminated lab coats, pens, notebooks, and other items that you use in the microbiology laboratory.
- Avoid taking laboratory supplies outside of the laboratory to limit contamination.
- Wash hands frequently while working in and immediately before leaving the microbiology laboratory and follow proper hand washing practices.
- Leave food, drinks or personal items like car keys, cell phones and mp3 players outside of the laboratory. These items may become contaminated if you bring them into the laboratory or touch them while working in the laboratory.

Advice to Students and Employees in Clinical and Teaching Microbiology Laboratories (Continued)

- Wear a lab coat or other protective garment over personal clothing when working in a microbiology laboratory. Remove protective garment before leaving for non-laboratory areas.
- If you work with *Salmonella* bacteria in a microbiology laboratory, be aware that these bacteria can make you sick. Watch for symptoms of *Salmonella infection*, such as diarrhea, fever, and abdominal cramps. Call your health care provider if you or a family member has any of these symptoms.
- Most persons infected with *Salmonella* develop diarrhea, fever, and abdominal cramps 12 to 72 hours after infection. The illness usually lasts 4 to 7 days, and most persons recover without treatment. However, in some persons, the diarrhea may be so severe that the patient needs to be hospitalized. *Salmonella* infection may spread from the intestines to the blood stream, and then to other body sites and can cause death unless the person is treated promptly with antibiotics. The elderly, infants, and those with impaired immune systems are more likely to have a severe illness from *Salmonella* infection.

Advice to Laboratory Directors, Managers, and Faculty Involved with Clinical and Teaching Microbiology Laboratories

- Either non-pathogenic or attenuated bacterial strains should be used when possible, especially in teaching laboratories.
- Persons working with infectious agents, including *Salmonella* bacteria, must be aware of potential hazards and trained and proficient in the practices and techniques required for handling such agents safely.
- All students and employees using the laboratory should be trained in biosafety practices.
- Ensure that handwashing sinks have soap and paper towels.
- Require students and employees to wash their hands before leaving the laboratory.

Advice to Laboratory Directors, Managers, and Faculty Involved with Clinical and Teaching Microbiology Laboratories (Continued)

- Do not allow lab coats to leave the microbiology laboratory, except to be cleaned by the institution.
- Do not allow food, drinks or personal items like car keys, cell phones and mp3 players to be used while working in the laboratory or placed on laboratory work surfaces.
- Provide students with dedicated writing utensils, paper, and other supplies at each laboratory station. These items should not be allowed to leave the laboratory.
- Maintain meticulous housekeeping